Typhoid Fever

(Also known as Enteric Fever)

Note: This chapter focuses on typhoid fever (caused by Salmonella Typhi). For information about non-typhoid salmonellosis, refer to the chapter entitled "Salmonellosis (Non-Typhoid)."

Section 1:

ABOUT THE DISEASE

A. Etiologic Agent

Typhoid fever is a systemic bacterial disease caused by *Salmonella* Typhi (not to be confused with *Salmonella* Typhimurium).

A new classification for *Salmonella* has been adopted based on DNA relatedness. This new nomenclature recognizes only two species: *Salmonella bongori* and *Salmonella enterica*, with all human pathogens regarded as serovars within the subspecies of *S. enterica*. For example, the proposed nomenclature would change *S. typhi* to *S. enterica* serovar Typhi, abbreviated *S.* Typhi, and *Salmonella enterica* serovar Enteritidis would be referred to as *S.* Enteritidis instead of *S. enteritidis.*

B. Clinical Description

Typhoid fever has a different presentation from salmonellosis. Initial symptoms typically include sustained fever, anorexia, lethargy, malaise, dull continuous headache, and non-productive cough. Vomiting and diarrhea are typically absent, but constipation is frequently reported. During the second week of illness, there is often a protracted fever and mental dullness, which is how the disease received the name "typhoid," which means "stupor-like." After the first week or so, many cases develop a maculopapular rash on the trunk and upper abdomen ("rose spots"). Other symptoms can include intestinal bleeding, slight deafness, and parotitis. Mild and atypical infections are common, but as many as 10–20% of untreated infections may be fatal (the case-fatality rate is <1% with prompt antibiotic treatment). Relapses are not uncommon. Paratyphoid fever is a similar illness, but it is usually much milder and is caused by the organism *Salmonella* Paratyphi.

C. Reservoirs

Humans are the reservoir for *S.* Typhi and *S.* Paratyphi. Domestic animals may harbor *S.* Paratyphi, but this is rare. Chronic carriers are the most important reservoir for *S.* Typhi. About 2–5% of cases become chronic carriers, some after symptomatic infection.

D. Modes of Transmission

S. Typhi is transmitted via the fecal-oral route, either directly from person to person or by ingestion of food or water contaminated with feces or urine. Shellfish harvested from sewage-contaminated water are potential vehicles, as are fruits and vegetables grown in soil fertilized with human waste in developing countries. Transmission can also occur from person to person through certain types of sexual contact (e.g., oral-anal contact).

E. Incubation Period

The incubation period for typhoid fever ranges from 3 days to 2 months (depending on the infecting dose), with a usual range of 8–14 days. For paratyphoid fever, the incubation period is usually 1–10 days.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *S.* Typhi or *S.* Paratyphi in the feces or urine. This usually begins about a week after onset of illness, continues through convalescence, and occurs for a variable period thereafter. If a carrier state develops, excretion of *S.* Typhi or *S.* Paratyphi could be permanent.

G. Epidemiology

The annual incidence of typhoid fever worldwide is approximately 17 million cases, with an estimated 600,000 deaths. In the U.S., less than 500 cases occur each year, and 70% of these are acquired while traveling internationally. Over the past ten years, travelers to Asia, Africa, and Latin America have been especially at risk. Antimicrobial-resistant strains are becoming increasingly prevalent. Outbreaks have occurred in the U.S. from food brought here from other countries. Despite suggestions to the contrary, outbreaks do not occur as a result of floods or other disasters in countries, such as the U.S., that are not endemic for typhoid.

H. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism, but intentional contamination of food or other materials could cause significant illness, disruption, and public concern.

Section 2:
REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report any isolation of *S.* Typhi from blood, stool, or other clinical specimens.

Note: For reporting information on S. Paratyphi and other Salmonella species, see the chapter titled "Salmonellosis (Non-Typhoid)." See Section 3C of this chapter for information on how to report a case.

B. Laboratory Testing Services Available

The MDPH State Laboratory Institute (SLI), Enteric Laboratory will test stool specimens for the presence of *S.* Typhi and will also perform confirmatory testing and serotyping on isolates from clinical specimens submitted by other laboratories. In addition, the SLI Enteric Laboratory requests submission of all *S.* Typhi isolates for serotyping for disease surveillance purposes.

For more information about testing and specimen submission, contact the SLI Enteric Laboratory at (617) 983-6609.

The SLI Food Microbiology Laboratory, at (617) 983-6610, will test implicated food items from case clusters or outbreaks for *S.* Typhi. See Section 4D for more information.

Section 3:
REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify whether the case may be a source of infection for other persons, and if so, to prevent further transmission.
- To identify sources of public health concern (e.g., a commercially-distributed food product, food handler, daycare attendee), and to stop transmission from such a source.

B. Laboratory and Health Care Provider Reporting Requirements

Typhoid fever is reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of typhoid fever, as defined by the reporting criteria in Section 2A.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of *S.* Typhi infection shall report such evidence of infection directly to the MDPH within 24 hours.

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Reporting Requirements

MDPH regulations *(105 CMR 300.000)* stipulate that typhoid fever (*S.* Typhi) is reportable to the LBOH and that each LBOH must report any case of typhoid fever or suspect case of typhoid fever, as defined by the reporting criteria in Section 2A. Cases should be reported to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS) using an official MDPH *Typhoid Fever Case Report Form* (found at the end of this chapter). Refer to the *Local Board of Health Timeline* at the end of this manual's *Introduction* section for information on prioritization and timeliness requirements of reporting and case investigation.

Case Investigation

1. It is the responsibility of the LBOH to complete a MDPH *Typhoid Fever Case Report Form* (found at the end of this chapter) by interviewing the case and others who may be able to provide information. Much of the information required on the form can be obtained from the health care provider or from the medical record.
2. Use the following guidelines to assist in completing the case report form:
   a. Accurately record the demographic information, including full name and address, date of symptom onset, symptoms, and other clinical information.
   b. Document diagnostic laboratory information, including the date specimen was collected, the type of test that was performed (usually culture), the test result, and the specimen source (usually blood or stool).

c. Household/close contact, daycare, and food handler questions are designed to examine the case's risk of having acquired the illness from or the case's potential for transmitting the illness to these contacts. Determine whether the case attends or works at a daycare facility and/or is a food handler.

d. Ask questions about travel history to help identify where the case became infected. When asking about exposure history (e.g., food, travel, activities), use the incubation period for *S.* Typhi (1–3 weeks). Specifically, focus on the period beginning a minimum of one week prior to the case's onset date back to no more than three weeks before onset.

e. If possible, record any restaurants at which the case ate, including food item(s) and date(s) consumed. If you suspect that the case became infected through food, use the MDPH *Foodborne Illness Complaint Worksheet* (found at the end of this chapter) to facilitate recording additional information. It is requested that the LBOH fax or mail this worksheet to the MDPH Center for Environmental Health, Food Protection Program (FPP); see top of worksheet for fax number and address. This information is entered into a database to help link other complaints from neighboring towns, thus helping to identify foodborne illness outbreaks.

Note: This worksheet does not replace the MDPH Typhoid Fever Case Report Form.

f. Ask questions about water supply; *S.* Typhi may be acquired through water consumption, although this would be unlikely to occur in the U.S.

g. Determine whether the case received typhoid vaccination within five years before onset of illness.

h. If you have made several attempts to obtain case information but have been unsuccessful (e.g., the case or health care provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the case report form with as much information as you have gathered. Please note on the form the reason(s) why it could not be filled out completely.

3. After completing both forms, attach laboratory report(s) and fax or mail (in an envelope marked "Confidential") to ISIS. The confidential fax number is (617) 983-6813. Call ISIS at (617) 983-6801 to confirm receipt of your fax. The mailing address is:

MDPH, Office of Integrated Surveillance and Informatics Services (ISIS)
305 South Street, 5th Floor
Jamaica Plain, MA 02130
Fax: (617) 983-6813

4. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

Section 4:

CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements *(150 CMR 300.200)*

Food handlers with *S.* Typhi must be excluded from work. For isolation and quarantine requirements for food handlers with *S.* Paratyphi or other *Salmonella* species, please refer to Section 4A of the chapter titled "*Salmonellosis (Non-Typhoid)*."

Minimum Period of Isolation of Patient

Food handling facility employees may return to work only after producing 3 consecutive negative stool specimens, each taken no less than 48 hours apart. If the case has been treated with an antimicrobial, the first stool specimen shall not be collected until at least 48 hours after cessation of therapy.

Minimum Period of Quarantine of Contacts

All food handling facility employees, symptomatic or asymptomatic, who are contacts of a typhoid case shall be considered the same as a case and shall be handled in the same fashion.

Note: A food handler is any person directly preparing or handling food. This can include a patient care or childcare provider. See Glossary (at the end of this manual) for a more complete definition.

B. Protection of Contacts of a Case

Members of households of known carriers are candidates for immunization against *S.* Typhi and should check with their health care providers for vaccine options.

C. Managing Special Situations

Daycare

Since typhoid fever may be transmitted from person to person through fecal-oral transmission, it is important to follow up on cases of typhoid fever in a daycare setting. General recommendations include:

- Children or staff members in a daycare center who test positive for *S.* Typhi should be excluded until 3 consecutive stool cultures taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy) are negative; and
- Stool specimens from all staff and attendees should be tested and all infected individuals should be excluded as well. Infected attendees less than 5 years of age should be excluded until they produce 3 negative stool specimens, and children 5 years of age and older should be allowed to return to the group setting only after going 24 hours without diarrheal stool.

School

Since typhoid fever may be transmitted from person to person through fecal-oral transmission, it is important to follow up on cases of typhoid fever in a school setting. Chapter 8 of the MDPH *Comprehensive School Health Manual* provides detailed information on case follow-up and control in a school setting. General recommendations include:

- Students or staff with *S.* Typhi who are experiencing symptoms, such as diarrhea, fever, and abdominal pain, should be excluded until symptoms have resolved.
- Students or staff with *S.* Typhi who do not handle food, have no symptoms, and are not otherwise ill may remain in school if special precautions are taken. If a case of *S.* Typhi occurs in a kindergarten, 1st grade, or a preschool class (where hygiene may not be optimal), more stringent control measures may be indicated (see *Daycare* section on the previous page).

Students or staff who handle food and have a *S.* Typhi infection (symptomatic or not) must not prepare or handle food for others until they have 3 negative stool specimens taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy) (per *105 CMR 300.200*).

Community Residential Programs

Actions taken in response to a case of *S.* Typhi in community residential programs will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *S.* Typhi should be placed on standard (including enteric) precautions until symptoms subside and they test negative with three consecutive stool specimens. (Refer to the MDPH Division of Epidemiology and Immunization *Control Guidelines for Long-Term Care Facilities* document for further actions. A copy can be obtained by calling the Division at [617] 983-6800 or [888] 658-2850. It is also available on the MDPH website at www.mass.gov/dph/cdc/epii/ltcf/ltcf.htm.) Close contacts in the long-term care facility, including staff and roommates, should also be tested. If positive, they should be placed on enteric precautions until they test negative with three stool cultures. Staff members with cultures positive for *S.* Typhi and who give direct patient care (e.g., feed patients, provide mouth or denture care, administer medications), are considered food handlers and must be excluded until they produce three negative stool specimens (per *105 CMR 300.200*).

In residential facilities for the developmentally disabled, staff and clients with *S.* Typhi must refrain from handling or preparing food for other residents until their symptoms have subsided and until they produce 3 negative stool specimens, taken 48 hours apart and no sooner than 48 hours after the cessation of antibiotic therapy (per *105 CMR 300.200*). Other close contacts in the facility should be tested as well, and if positive, should be subject to the same restrictions stated above.

Reported Incidence Is Higher Than Usual/Outbreak Suspected

If one or more cases of *S.* Typhi is reported in your city/town among people who have not traveled out of the U.S., investigate the case(s) to determine the source of infection and the mode of transmission. A common vehicle (e.g., water, food, or association with a daycare center) should be determined, and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal hygiene and sanitary disposal of feces. Consult with the epidemiologist on-call at the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases across town lines, which would otherwise be difficult to identify at the local level.

Note: Refer to the MDPH Foodborne Illness Investigation and Control Reference Manual for comprehensive information on investigating foodborne illness complaints and outbreaks. Copies of this manual have been made available to LBOH. It can also be located on the MDPH website in PDF format at www.mass.gov/dph/fpp/refman.htm. For the most recent changes to the Massachusetts Food Code, contact the FPP at (617) 983-6712 or through the MDPH website at www.mass.gov/dph/fpp.

D. Preventive Measures

Environmental Measures

Implicated food items must be removed from consumption. A decision about testing implicated food items can be made in consultation with the FPP or the MDPH Division of Epidemiology and Immunization. The FPP can help coordinate pickup and testing of food samples. If a commercial product is suspected, the FPP will follow-up with relevant outside agencies.

Note: The role of the FPP is to establish policy and to provide technical assistance with the environmental investigation, such as interpreting the Massachusetts Food Code, conducting a Hazard Analysis and Critical Control Point (HACCP) risk assessment, initiating enforcement actions, and collecting food samples.

The general policy of the SLI is to test only food samples implicated in suspected outbreaks, not single cases (except when botulism is suspected). However, leftover food consumed within the incubation period by a single, confirmed case of domestically acquired typhoid fever will most likely be prioritized for testing.

Personal Preventive Measures/Education

To avoid exposure, recommend that individuals:

- Always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after touching pets or other animals (especially reptiles).
- Wash the child's hands as well as their own hands after changing a child's diapers, and dispose of feces in a sanitary manner.
- Wash hands thoroughly and frequently when ill with diarrhea or when caring for someone with diarrhea. Hands should be scrubbed for at least 15–20 seconds after cleaning the bathroom; after using the toilet or helping someone use the toilet; after changing diapers; before handling food; and before eating.

Discuss transmission risks that may result from oral-anal sexual contact and contact with feces or urine. Latex barrier protection (e.g., dental dam) may prevent the spread of *S.* Typhi to a case's sexual partners and may prevent exposure to and transmission of other fecal-oral pathogens.

International Travel

Persons traveling to typhoid endemic areas should consider vaccination against typhoid fever. They should check with their health care provider or a travel clinic for vaccine options. This needs to be done in advance so that the vaccine has time to take effect. Typhoid vaccines lose effectiveness after several years; people vaccinated in the past should check with their doctor to see if they need a booster. Typhoid vaccine is not 100% effective; therefore, travelers must exercise caution when consuming local foods and beverages (which will also protect travelers from other illnesses such as travelers' diarrhea, cholera, dysentery, and hepatitis A).

Recommend the following to travelers:

- "Boil it, cook it, peel it, or forget it." Avoid foods and beverages from street vendors.
- Drink only bottled or boiled water, keeping in mind that bottled carbonated water is safer than non-carbonated bottled water.
- Ask for drinks without ice, unless the ice is made from bottled or boiled water.

- Avoid popsicles and flavored ices that may have been made with contaminated water.
- Eat foods that have been thoroughly cooked and are still hot and steaming.
- Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to thoroughly wash.

Note: For more information regarding international travel and the typhoid fever vaccine, contact the Centers for Disease Control and Prevention (CDC), Traveler's Health Office at (877) 394-8747 or on the CDC website at www.cdc.gov/travel.

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for typhoid fever. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: The most up-to-date CDC case definitions are available on the CDC website at www.cdc.gov/epo/dphsi/casedef/case_definitions.htm.

Clinical Description

An illness caused by *S.* Typhi that is often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and non-productive cough. However, many mild and atypical infections occur.

Laboratory Criteria for Diagnosis

Isolation of *S.* Typhi from blood, stool, or other clinical specimen.

Case Classification

Probable	A clinically-compatible case that is epidemiologically-linked to a confirmed case in an outbreak.
Confirmed	A clinically-compatible case that is laboratory-confirmed.

Comment

Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Carriage without appropriate symptoms would not be considered typhoid fever.

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FORMS & WORKSHEETS

Typhoid Fever

(Also known as Enteric Fever)

Typhoid Fever

(Also known as Enteric Fever)

LBOH Action Steps

This form does not need to be submitted to the MDPH with the case report form. It is for LBOH use and is meant as a quick-reference guide to typhoid fever case investigation activities.

LBOH staff should follow these steps when typhoid fever is suspected or confirmed in the community. For more detailed information, including disease epidemiology, reporting, case investigation, and follow-up, refer to the preceding chapter.

- ❑ Notify the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 or (888) 658-2850, to report any suspect or confirmed case(s) of typhoid fever.
- ❑ Obtain laboratory confirmation.
- ❑ For typhoid fever suspected to be the result of food consumption, complete a MDPH *Foodborne Illness Complaint Worksheet* and forward to the MDPH Center for Environmental Health, Food Protection Program (FPP).
- ❑ Contact the MDPH Division of Epidemiology and Immunization or the FPP to discuss whether or not to submit suspect foods for testing.
- ❑ Identify other potential exposure sources, such as a water source.
- ❑ Determine whether the case attends or works at a daycare facility and/or is a food handler.
- ❑ Identify other potentially exposed persons.
- ❑ Institute isolation and quarantine requirements (*105 CMR 300.200*), as they apply to a particular case.
- ❑ Fill out the case report form (attach laboratory results).
- ❑ Send the completed case report form (with laboratory results) to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS).